

Appl. No. 10/724,483
Amtd. Dated 07/27/2006
Reply to Office action of July 7, 2006

REMARKS/ARGUMENTS

This is an Amendment After Final in response to an Office Action dated July 7, 2006.

Status

Claims 1, 3-15 and 21-26 are pending

Claims 15 and 21-26 are allowed

Claims 1 and 3-14 are rejected

Claims 3 and 9 are objected to

Claim Objection(s)

Claims 3 and 9 are object to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. To further clarify, as admitted by applicant in the response filed 4-26-06, the scope of the claim 1 term "gate oxide" is limited to "silicon dioxide (SiO₂), silicon oxynitride (SiON), silicon nitride (SiN) or high-k."

In the rejections infra, generally, reference labels are recited only for the first recitation of identical claim elements.

Claims 3 and 9 are canceled.

Rejection(s) under 35 USC 102(e)

Claims 1, 6 and 12 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Jeong (6780715).

At column 7, line 8 to column 8, line 14, Jeong discloses method of forming different gate oxides on a semiconductor substrate, the substrate having a top surface, a first area and second area which is distinct from the first area, comprising: forming a first gate oxide 74 on the top surface of the substrate; depositing a first layer of polysilicon 75 over the first gate oxide; forming a hard mask 76 on top of the first layer of polysilicon; forming a soft mask 77 covering the first gate oxide, first layer of polysilicon and hard

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mask in the first area of the substrate; removing the hard mask, the first layer of polysilicon and the first gate oxide in the second area of the substrate, leaving the second area exposed; stripping the soft mask; inherently cleaning the exposed second area of the substrate "etched selectively by using the first photoresist pattern layer 77 as a mask, so that the substrate 70 in the memory region 72 and the boundary area of the logic region 71 is exposed"; growing a second gate oxide 78 on the top surface of the substrate in the second area; and removing the hard mask; after removing the hard mask depositing a second layer of polysilicon 79 in both the first and second areas; wherein: the hard mask comprises a material selected from the group consisting germanium (Ge), silicon germanium (SiGe), amorphous carbon, SiO₂, Si₃N₄, and other materials that are easy to remove from a silicon wafer without leaving a residue; and wherein: the first gate oxide is thinner than the second gate oxide.

Claims 1, 6 and 12 are cancelled and the rejection is now moot.

Rejection(s) under 35 U.S.C. 103(a)

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

All of the various claims were commonly owned at the time any inventions covered therein were made.

Claims 4, 5, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeong (6780715).

Jeong is applied as applied to claim 1.

However, Jeong does not appear to explicitly disclose wherein:

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wherein the first gate oxide has a thickness of approximately 5-25 angstroms; wherein the first layer of polysilicon has a thickness of approximately 20-500 angstroms; the hard mask has a thickness of approximately 300-500 Angstroms; choosing an initial thickness for the hard mask to ensure that after stripping the soft mask, a thickness of greater than approximately 15 angstroms of hard mask material remains in place on the substrate.

Notwithstanding, as cited, Jeong discloses that the first gate oxide thickness is a result effective variable. Moreover, as reasoned from well established legal precedent, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

To further clarify, the scope of the limitation, "choosing an initial thickness for the hard mask to ensure that after stripping the soft mask, a thickness of greater than approximately 15 angstroms of hard mask material remains in place on the substrate" is not limited to a step of stripping the soft mask, and, a thickness of greater than approximately 15 angstroms of hard mask material remains in place on the substrate, because the language, "to ensure that after stripping the soft mask, a thickness of greater than approximately 15 angstroms of hard mask material remains in place on the

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substrate" is a statement of intended purpose of the hard mask thickness that does not appear to result in a manipulative difference between the claimed mask and the mask of Jeong. Further, because the mask of Jeong appears to have the same structure as the claimed mask, it appears to be inherently capable of being used for the intended purpose, and the statement of intended purpose does not patentably distinguish the claimed mask from the mask of Jeong. The manner in which a product operates is not germane to the issue of patentability of the product; Ex parte Wikdahl 10 USPQ 2d 1546, 1548 (BPAI 1989); Ex parte McCullough 7 USPQ 2d 1889, 1891 (BPAI 1988); In re Finsterwalder 168 USPQ 530 (CCPA 1971); In re Casey 152 USPQ 235, 238 (CCPA 1967). Also, "Expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim."; Ex parte Thibault, 164 USPQ 666, 667 (Bd. App. 1969). And, "Inclusion of material or article worked upon by a structure being claimed does not impart patentability to the claims."; In re Young, 25 USPQ 69 (CCPA 1935) (as restated in In re Otto, 136 USPQ 458, 459 (CCPA 1963)). And, claims directed to product must be distinguished from the prior art in terms of structure rather than function. In re Danley, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover what a device is, not what a device does [or is intended to do]." Hewlett-Packard Co. v. Bausch & Lomb Inc., 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Claims 4, 5, 7 and 8 are canceled and the rejection is now moot.

Claims 9 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeong as applied to claim 1, and further in combination with Radens (6388294).

Jeong does not appear to explicitly disclose wherein the second gate oxide comprises a material selected from the group consisting of silicon dioxide (SiO₂), silicon oxynitride (SiON), silicon nitride (SiN) and high-k material; wherein the second gate oxide has a composition that is different than a composition of the first gate oxide.

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Nonetheless, at column 3, lines 25-33 and column 5, lines 24-49, Radens discloses wherein a gate oxide 106 comprises silicon dioxide (SiO₂); wherein a second gate oxide 170 has a composition that is different than a composition of the first gate oxide. Moreover, it would have been obvious to combine this disclosure of Radens with the disclosure of Jeong because it would provide the second gate oxide of Radens and permit optimization of thickness and formation conditions or different selected regions of the semiconductor substrate.

Claims 9 and 14 are canceled and the rejection is now moot.

Claims 3, 10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeong as applied to claim 1, and further in combination with Radens (6388294).

Jeong does not appear to explicitly disclose wherein the second gate oxide is grown by a process selected from the group consisting of: rapid thermal oxidation (RTO) in NO, N₂O, NH₃, O₂ (500-1100 degrees C); plasma nitridation treatment on base oxide (25 - 800 degrees C); plasma oxidation; UV oxidation; and atomic layer deposition; and wherein the first gate oxide comprises a high-k material.

Nevertheless, at paragraph 6, Radens discloses wherein a gate oxide comprising a high-k material is grown by atomic layer deposition. Furthermore, it would have been obvious to combine this disclosure of Radens with the disclosure of Jeong because it would insure a uniform composition and thickness of the gate oxide.

Claims 3, 10 and 13 are canceled and the rejection is now moot.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jeong as applied to claim 1, and further in combination with Lin (6063760).

Jeong does not appear to explicitly disclose wherein during growing the step of growing

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the second gate oxide, a portion of the hard mask becomes oxidized; and further comprising: removing the oxidized portion of the hard mask using an etch that will remove the oxidized portion of the hard mask without affecting the second gate oxide.

Notwithstanding, at 3, lines 4-24; and column 3, line 66 to column 4, line 19, Un discloses during the step of growing a second gate oxide 30, a portion of the hard mask 22 becomes oxidized; and further comprising: removing the oxidized portion of the hard mask using an etch "water" that will remove the oxidized portion of the hard mask without affecting the second gate oxide. In addition, it would have been obvious to combine this disclosure with the disclosure of Jeong because it would it would prevent or minimize the first gate oxide from growing thicker.

Claim 11 is canceled and the rejection is now moot.

Claims 15 and 21-26 are allowed.

The art made of record and not applied to the rejection is considered pertinent to applicant's disclosure. It is cited primarily to show inventions relevant to the examination of the instant invention.

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Conclusion

Since all of the pending claims have already been indicated as being allowable by the Examiner, Applicant respectfully requests that a timely Notice of Allowance be issued in this case. If there are any further issues to be resolved, the Examiner is invited to contact the

Respectfully submitted,



Howard M. Cohn
Registration No. 25,808

Howard M. Cohn
21625 Chagrin Blvd. Suite 220
Cleveland, OH 44122
Voice (216) 752-0955
Fax (216) 752-0957

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